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मानक

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“Step Out From the Old to the New”

IS 68 (2006): China clay (Kaolin) for paints [CHD 20: Paints, Varnishes and Related Products]



“ज्ञान से एक नये भारत का निर्माण”

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“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
पेन्ट के लिए चायना मिट्टी (काओलिन) — विशिष्टि
(दूसरा पुनरीक्षण)

Indian Standard
CHINA CLAY (KAOLIN) FOR
PAINTS — SPECIFICATION
(*Second Revision*)

ICS 87.060.10

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Paints, Varnishes and Related Products Sectional Committee had been approved by the Chemical Division Council.

This standard was first published in 1950 and revised in 1979. However, the Committee decided to revise it further to bring it in line with the latest developments in the field.

In the first revision, two grades of the material, namely, ordinarily ground and micronized were included and additional requirements for loss on ignition, settling tendency, flow point and stiff point were also added.

In this revision, additional requirements for water demand, carbonates as CO₂, opacity, particle size distribution and fineness have been included. Requirements for matter soluble in water and residue on sieve have been modified.

This standard contains clause 6.1 which calls for agreement between the purchaser and the supplier.

The composition of the Committee responsible for the formulation of this standard is given in Annex J.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

CHINA CLAY (KAOLIN) FOR PAINTS — SPECIFICATION

(*Second Revision*)

1 SCOPE

This standard prescribes the requirements and methods of sampling and tests for the material commercially known as kaolin or china clay, for use as an extender in paint industry.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
33 : 1992	Inorganic pigments and extenders for paints — Methods of sampling and test (<i>third revision</i>)
1070 : 1992	Reagent grade water (<i>third revision</i>)
1303 : 1983	Glossary of terms relating to paints (<i>second revision</i>)

3 TERMINOLOGY

For this purpose of this standard, the definitions given in IS 33 and IS 1303 shall apply.

4 GRADES

The material shall be of following two grades:

Grade 1 — Ordinary ground (63 micron), and

Grade 2 — Micronized (finely ground) (32 micron).

5 REQUIREMENTS

5.1 Composition

The material shall be a neutral product consisting essentially of hydrated aluminium silicate. When carbonates are present, the total carbonates as CO_2 shall not exceed 1 percent by mass.

5.2 Form and Condition

The material shall be in the form of a dry powder or in such a condition that it can be reduced to the powder form by crushing, without grinding action, under palette knife.

5.3 When lead-free kaolin is required, it shall contain not more than 0.03 percent of lead or compounds of lead (calculated as metallic lead), when tested by the method specified under 25 of IS 33.

5.4 The material shall also comply with the requirements given in Table 1.

6 PACKING AND MARKING

6.1 Packing

The material shall be suitably packed as agreed to between the purchaser and the supplier.

6.2 Marking

6.2.1 Each package shall be marked with the following information:

- a) Name and grade of the material;
- b) Manufacturer's name and registered trade-mark, if any;
- c) Mass of the material;
- d) Batch No. or Lot No. in code or otherwise; and
- e) Month and year of manufacture.

6.2.2 BIS Certification Marking

Each package may also be marked with the Standard Mark.

6.2.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

7 SAMPLING

7.1 Preparation of Test Samples

Representative samples of the material shall be prepared as prescribed under 5 of IS 33.

7.2 Number of Tests

Tests for the determination of all the characteristics specified shall be conducted on the composite sample.

Table 1 Requirements for China Clay (Kaolin) for Paints
(Clause 5.4)

Sl No.	Characteristic		Requirement		Methods of Test, Ref to	
			Grade 1	Grade 2	Annex	Clause No. of IS 33
(1)	(2)		(3)	(4)	(5)	(6)
i)	Volatile matter, percent by mass, <i>Max</i>		2.0		—	8
ii)	Residue on sieve, percent by mass, <i>Max</i>		1.0 on 63 micron IS Sieve	0.3 on 32 micron IS Sieve	—	9
iii)	Oil absorption ¹⁾		25 – 35	25 – 40	—	10
iv)	Matter soluble in water, percent by mass, <i>Max</i>		0.3		—	19
v)	pH value of 5 percent aqueous extract		6.0 – 8.5	6.0 – 8.5	—	21
vi)	Colour		Close match to approved sample		A	—
vii)	Water demand	Stiff point	As agreed to between the purchaser and the supplier		B	—
		Flow point	As agreed to between the purchaser and the supplier			
viii)	Whiteness and opacity		Close match to approved sample		C	—
ix)	Particle size distribution, percent by mass, finer than 10 microns, <i>Min</i>		As agreed to between the purchaser and the supplier		D	—
x)	Carbonates as CO ₂ , percent by mass, <i>Max</i>		1.0		E	—
xi)	Loss on ignition, percent by mass		10 to 14		F	—
xii)	Settling tendency		To pass the test		G	—
xiii)	Fineness		As agreed to between the purchaser and the supplier		H	—

¹⁾ This shall, however, be within ±10 percent of the approved sample, if any.

7.3 Criteria for Conformity

The material shall be taken as conforming to this standard, if the composite sample satisfies all the requirements prescribed in 5.

8 TEST METHODS

8.1 Tests shall be conducted as prescribed in Annex A to H of this standard and in IS 33. Reference to relevant Annex and clauses of IS 33 appears in col 5

and 6 of Table 1.

8.2 Quality of Reagents

Unless otherwise specified, pure chemicals and distilled water (see IS 1070) shall be employed in tests.

NOTE — ‘Pure chemicals’ shall mean chemicals that do not contain impurities which affect the results of analysis.

ANNEX A

[Table 1, Sl No. (vi)]

DETERMINATION OF COLOUR

A-1 GENERAL

The colour of a coloured pigment is compared with that of an approved sample.

A-2 REAGENTS

A-2.1 Soyabean Oil

A-3 APPARATUS

A-3.1 Palette Knife — Tapered steel blade of approximately 140 to 150 mm long, 20 to 25 mm wide at its widest point and not less than 12.5 mm wide at its narrowest point.

A-3.2 Plate, Ground Glass or Marble

A-3.3 Glass Panel — Clear colourless glass of minimum area 150 mm × 50 mm.

A-4 PROCEDURE

A-4.1 Take approximately 5 g of sample. Put soyabean oil drop wise on the sample and make a thick paste to apply on the panel.

A-4.2 Repeat the same as in A-4.1 with the approved sample.

A-4.3 Apply both the pastes side by side on the glass panel. The strips shall be of approximately 25 mm wide with touching the edges not less than 40 mm long.

A-4.4 Compare the colour by examining the strips in diffuse day light on the surface through the glass immediately after application. Where good day light is not available, make the comparison in artificial day light.

ANNEX B

[Table 1, Sl No. (vii)]

DETERMINATION OF WATER DEMAND

B-1 REAGENTS

0.5 percent (w/v) sodium hexameta phosphate (A.R. grade) solution in water.

B-2 APPARATUS

B-2.1 Burette — 50 ml.

B-2.2 Beaker — 100 ml.

B-2.3 Glass Rod, of suitable length for stirring.

B-2.4 Weighing Balance (with 0.01 g Precision)

B-3 PROCEDURE

B-3.1 Test for Stiff Point

Weigh 10 g of sample (nearest to second place of decimal) in a 100 ml beaker. Add sodium hexametaphosphate solution drop by drop carefully with constant stirring with the glass rod. Stiff point is indicated when there is no more free particles of powder, that is when the particles are converted into lump. Note the reading on the burette and calculate stiff point (V_1).

B-3.2 Test for Flow Point

Continue addition of sodium hexameta phosphate solution, drop by drop in the beaker (see B-3.1) with simultaneous stirring of the paste form, till the paste obtained is having consistency such that after inclining the beaker by 45°, the paste just starts flowing. Note the reading on the burette and calculate the flow point (V_2).

B-4 CALCULATION

$$\text{Stiff point} = \frac{V_1 \times 100}{M}$$

$$\text{Flow point} = \frac{V_2 \times 100}{M}$$

where

V_1 = volume of solution required for converting the sample into paste, in ml;

V_2 = volume of solution required for the sample to reach flow point condition, in ml; and

M = mass of the sample taken for test, in gram.

ANNEX C

[Table 1, Sl No. (viii)]

DETERMINATION OF WHITENESS AND OPACITY

C-1 REAGENTS

C-1.1 Soft Water

C-1.2 Anionic Wetting Agent

C-1.3 Non-ionic Wetting Agent

C-1.4 Hydroxy Ethyl Cellulose

C-1.5 Any emulsion resin used for emulsion paint.

C-2 APPARATUS

C-2.1 Container — 200 ml.

C-2.2 Mechanical Stirrer — Laboratory grade.

C-3 PROCEDURE

C-3.1 Mix the following ingredients with the help of the stirrer in the order as stated below to make a uniform gel:

a) Soft water : 20.00 P.b.w.

b) Anionic wetting agent : 0.50 P.b.w.

c) Non-ionic wetting agent : 0.50 P.b.w.

d) Hydroxy ethyl cellulose : 0.20 P.b.w.

C-3.2 Add 50 g of the material under test slowly with the gel under stirring to make a uniform and homogenous paste.

C-3.3 Add 25 g emulsion resin to the mixture in slow speed of stirring and homogenize.

C-3.4 Add 4 ml soft water and mix for 5 min.

C-3.5 Repeat C-3.1 to C-3.4 with the approved sample.

C-3.6 Make draw down of the above two pastes side by side on a contrast ratio paper (black and white 50 : 50) with K7 Bar Coater (wet film thickness approximately 75 to 80 micron).

C-3.7 Dry at 45°C for 2 h.

C-3.8 Compare the opacity and whiteness visually.

ANNEX D

[Table 1, Sl No. (ix)]

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

D-1 GENERAL

Because of the ease of execution and good reproducibility the Andreasen method is included as the referee method. Other methods may, however, be used by agreement between the concerned parties, but in such cases it will be necessary also to agree on appropriate limits.

D-2 PRINCIPLE

The rate of fall of spherical particles through a medium in which they are dispersed is proportional to the square of the particle diameter (Stokes' law). The Andreasen method for determination of particle size distribution makes use of this relationship and expressed the particle size distribution in terms of distribution of spherical particles of the same settlement rate. In this determination, a dilute suspension is prepared and the concentration of solids at a fixed point below the surface is determined at a series of time intervals calculated to correspond to certain equivalent spherical diameters.

D-3 APPARATUS — See Fig. 1.

D-3.1 Sedimentation Vessel — of glass about 56 mm internal diameter and having a graduated scale from 0 to 200 mm marked on its side. The zero graduation line shall not be less than 25 mm from the inside base of the vessel and the capacity of the vessel up to the 200 mm mark shall be about 550 to 620 ml.

D-3.2 Pipette — fitted with a two-way tap and side discharge tube. The capacity of the pipette to the graduation line is conveniently 10 ml. A bell-shaped dome with a ground glass joint to fit the neck of the sedimentation vessel is fused to the pipette. A small vent hole is made in this dome. The inlet to the pipette stem shall be level with the zero line on the sedimentation vessel. The stem from the pipette bulb to the sampling inlet shall be constructed of capillary glass tubing with a bore not less than 1 mm and not more than 1.3 mm. The tube above the bulb shall be 4 to 4.5 mm bore.

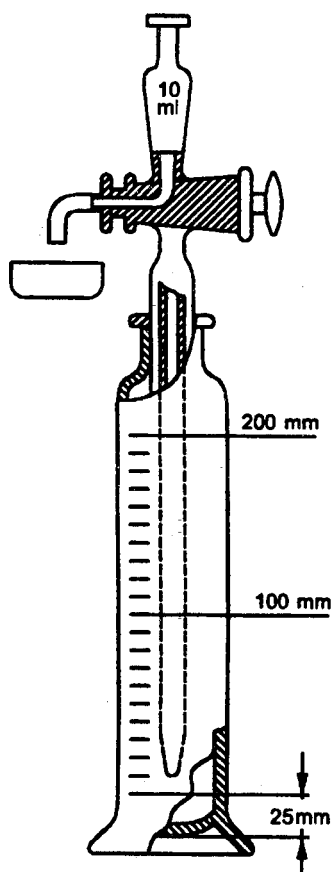


FIG. 1 SEDIMENTATION VESSEL AND PIPETTE

D-3.3 Constant-Temperature Bath — transparent-sided of at least 15 litres capacity, maintained at a temperature of $27 \pm 0.5^\circ\text{C}$, into which the sedimentation vessel can be immersed up to the 200 mm graduation mark. The bath shall be positioned away from sources of vibration.

D-3.4 Mechanical Stirrer — capable of rotating at a suitable speed for complete dispersion ($1\,000 \pm 100$ rpm is generally suitable). The stirrer shall be designed to lift the dispersion and to avoid the creation of a vortex.

NOTE — A suitable stirrer may be made from an approximately 40 mm diameter brass disc with four equally spaced cuts, the cut sections being turned upwards at an angle of 30° to the horizontal.

D-3.5 Dispersion Vessel — of appropriate dimensions, such as a 1 000 ml gas jar.

D-3.6 Balance — having a sensitivity of not less than 0.1 mg.

D-3.7 Drying Oven — capable of being maintained within a temperature range suitable for evaporation of the suspending liquid, for example, $105 \pm 2^\circ\text{C}$ for water.

D-3.8 Weighing Bottles — wide-mouthed, suitable

for evaporation, of capacity not less than 20 ml, or a small laboratory centrifuge and centrifuge tubes preferably of 20-ml capacity but of not less than 10-ml capacity.

D-3.9 Stop-Watch or Stop-Clock

D-4 PREPARATION FOR THE TEST

D-4.1 Calibration of Pipette

Thoroughly clean the pipette. Partly fill the sedimentation vessel with water. Set the top in the sampling position and by means of a rubber tube suck water into the bulb to the level of the graduation line. Reverse the tap to the discharge position and allow the water to drain into a tared weighing bottle. Apply pressure through the rubber tube to blow any water remaining in the bulb and the discharge tube into the weighing bottle. Weigh the bottle to the nearest 0.001 g and calculate from this mass the internal volume V_p of the pipette.

D-4.2 Calibration of Sedimentation Vessel

Thoroughly clean the sedimentation vessel, weigh it, with the pipette in place, to the nearest 0.1 g. Then fill it to the 200 mm mark with water at $27 \pm 0.5^\circ\text{C}$ and reweigh. Calculate from the mass of water the internal volume V_g of the vessel.

D-4.3 Sample for Analysis

Using 3.5 g of accurately weighed material with 0.07 to 0.14 g of suitable dispersing materials (*see Note*), prepare a dispersion by placing the test portion in the dispersion vessel adding dispersion solution at $27 \pm 0.5^\circ\text{C}$ to give a total volume of about 500 ml and stirring with the mechanical stirrer for 15 min. Immediately pour all the suspension into the sedimentation vessel and make up to the 200 mm line with water or aqueous alcohol as appropriate. Transfer the sedimentation vessel to the constant temperature bath.

NOTE — Certain sodium salts of polymethacrylates have been found most suitable. Such materials are sold as polysalts, dispex, etc.

D-5 PROCEDURE

D-5.1 Sedimentation

Allow the sedimentation vessel to stand immersed to the 200 mm mark until it has reached the temperature of the bath. Record this temperature, which shall not differ greatly from that of the room. When temperature equilibrium has been attained, mix the contents thoroughly by placing a finger over the vent hole and inverting the vessel several times. Immediately after mixing, replace the vessel and start the stop-clock or stop-watch.

D-5.2 Withdraw from the suspension by means of the pipette a series of samples of volume V_p at depths h_n at increasing time intervals after mixing, starting at time t_1 corresponding to a particle size of about 20 micron (calculated in accordance with D-5.3) and thereafter in progression so that the limiting diameters stand in a $\sqrt{2} : 1$ progression. Alternatively, the samples may be taken at convenient times approximately in a 2 : 1 progression and the exact spherical particle diameters corresponding to each sample calculated. The time to fill the pipette shall be about 20 s.

D-5.3 Discharge the suspension from the pipette into a tared weighing bottle. When the bulb has drained, remove the rubber suction tube and run 5 to 7 ml of water from an ordinary 10 ml pipette into the bulb of the sedimentation pipette to wash into the weighing bottle any particles adhering to the surface. The stem of the sedimentation pipette shall remain filled with suspension. Dry the contents of the weighing bottle at 105°C until the difference between successive weighings is not greater than 0.1 mg. Calculate the mass of the fraction m_n allowing for the mass of dispersing agent, which shall be determined by carrying out a blank test. The determination of different fractions may be carried out by means of chemical methods if that procedure is more suitable.

D-5.4 The depth of immersion of the pipette decreases as each fraction is withdrawn. Determine the exact decrease in depth by experiment and allow for it in the subsequent calculation. Suppose that the decrease is 4 mm for each fraction withdrawn, and that initially the depth of immersion of the pipette was 200 mm, then the depth after the first fraction has been withdrawn will be 196 mm, and the mean depth h_1 used for calculation of the initial diameter corresponding to the first fraction will be 198 mm. The mean depth h_2 for the second fraction will be 194 mm, and so on.

D-5.5 Calculation of Withdrawal Time

The withdrawal time, t_n , in seconds, for the n th sample is given by the equation:

$$t_n = \frac{18\sigma h_n \times 10^6}{(\mu_2 - \mu_1) g d_n^2}$$

where

- σ = absolute viscosity, of the medium, in NS/m²;
- h_n = depth, at which the n th sample extraction is made, in mm;
- μ_1 = density, of the medium, in megagram/m³;
- μ_2 = density, of the particle, in megagrams/m³ or g/cm³;
- g = acceleration due to gravity, m/s²; and
- d_n = limiting stokes diameter, corresponding to the n th sample extraction in, micro metres.

D-6 CALCULATION

D-6.1 The cumulative percentage by mass, P_n , of particles smaller than each of the limiting stokes diameter d_n for each time interval t_n is given by the formula:

$$P_n = \frac{m_n \times V_g}{m_g \times V_p} \times 100$$

where

- m_n = mass of the fraction corrected for the mass of the dispersing agent, in g;
- V_g = volume of the sedimentation vessel, in ml;
- m_g = mass of the test portion, in g; and
- V_p = volume of the pipette, in ml.

D-6.2 Repetition of Test

Repeat the procedure on a further amount of suspension prepared from the same sample. The results of the test shall be accepted only if the percentages by mass, less than the same limiting stokes diameter, do not differ by more than 4 percent.

D-6.3 Expression of Results

Plot the results of the analysis with the micrometric sizes as abscissae and the percentages undersize as ordinates. From the smooth curve drawn through the points, select the cumulative percentages corresponding to the series required. Repeat the results to the nearest 1 percent.

ANNEX E

[Table 1, Sl No. (x)]

DETERMINATION OF CARBONATES AS CO₂

E-1 REAGENTS

E-1.1 Dilute Hydrochloric Acid

E-1.2 Concentrated Sulphuric Acid

E-1.3 Methanol (A.R. Grade)

E-2 APPARATUS

E-2.1 Schroetter's Alkalimeter — See Fig. 2.

E-2.2 Test Tube

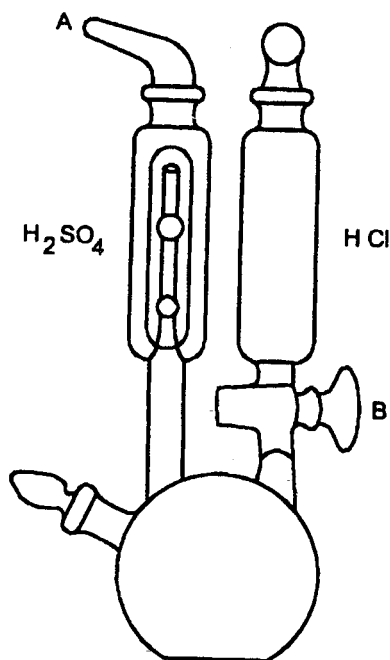


FIG. 2 SCHROETTER'S ALKALIMETER

E-2.3 Watch Glass

E-2.4 Beaker — 100 ml.

E-2.5 Glass Rod

E-2.6 Balance (0.01 g Precession)

E-3 PROCEDURE

E-3.1 Take dilute hydrochloric acid (1 : 1) and concentrated sulphuric acid in the bulbs as indicated in the figure. Weigh the apparatus (W_1).

E-3.2 Take about 0.5 g of the sample at the bottom with the help of a small funnel. Weigh the apparatus (W_2).

E-3.3 The dilute hydrochloric acid (1 : 1) is allowed to flow down on the sample with slight swirling.

E-3.4 Place the apparatus over low flame about 3 min just to boiling.

E-3.5 Cool the apparatus on a closed balance to cool at room temperature.

E-3.6 Weigh the apparatus (W_3).

E-4 CALCULATION

$$\text{Percentage of carbonates as CO}_2 = \frac{(W_2 - W_3)}{(W_2 - W_1)} \times 100$$

where

W_1 = initial weight of the apparatus,

W_2 = weight of the apparatus and the sample, and

W_3 = final weight of the apparatus.

ANNEX F

[Table 1, Sl No. (xi)]

DETERMINATION OF LOSS ON IGNITION

F-1 APPARATUS

F-1.1 Porcelain or Platinum Dish — Shallow.

F-1.2 Muffle Furnace

F-2 PROCEDURE

Weigh, to the nearest 0.001 g, about 2 g of

the test samples, previously dried as described under 7 of IS 33 into the tared platinum or porcelain dish, ignite in the muffle furnace at $1\,000 \pm 25^\circ\text{C}$ to constant mass and cool in a desiccator containing phosphorus pentaoxide.

F-3 CALCULATION

The loss on ignition, as a percentage by mass, is given

by the formula:

$$\frac{100 (M_1 - M_2)}{M_1}$$

where

M_1 = mass of the sample taken for test, in g;
and

M_2 = mass of the sample after ignition, in g.

ANNEX G

[Table 1, *Sl No. (xii)*]

TEST FOR SETTLING TENDENCY

G-1 APPARATUS

G-1.1 Stoppered 100 ml Cylinder — Graduated.

G-1.2 Water Bath of Temperature, $25 \pm 1^\circ\text{C}$

G-1.3 Thermometer for Water Bath

G-2 PROCEDURE

Weigh accurately 20 g of the whiting on butter paper and transfer it to the clean 100 ml measuring cylinder. Add water to make volume 100 ml thoroughly shake the cylinder after putting glass stopper. In another measuring cylinder of similar dimensions take 20 g of approved sample and make volume by adding water to 100 ml. Shake thoroughly. Keep both the cylinders in the water bath for

30 min, maintained at $25 \pm 1^\circ\text{C}$ temperature. Remove both measuring cylinders and shake thoroughly and again keep in the water bath. Note the time. Observe the cylinders after 1 h without disturbing. The sample shall have settled layer comparable to or less than that of approved sample. Also observe the top layer which shall have clarity comparable to that of approved sample. None (if necessary) the reading of the cylinder, both for the bottom settled layer and top clear solution.

G-3 REPORT

The material shall be taken to have passed this test, if the sample under test shall show a comparable behaviour to that of the approved sample.

ANNEX H

[Table 1, *Sl No. (xiii)*]

DETERMINATION OF FINENESS (HEGMAN)

H-1 APPARATUS

H-1.1 Automatic Muller — 5 kg weight.

H-1.2 Hegman Gauge

H-2 REAGENT

H-2.1 Refined Soyabean Oil

H-3 PROCEDURE

Weigh approximately 2 g of the extender in a watch glass. Transfer the sample on the top plate of the automatic muller and add 1.5 g (approximately) through

dropper. To make a paste by palette knife, spread the paste on both the plates and run the muller for 1 min. Repeat the grinding for another 1 min after remixing and spreading on the plate. Add oil to mix and to get a suitable consistency for checking Hegman. Place few ml of the mixture on the clean Hegman Gauge at the top and pull the same concentration to the gauge from top to bottom by sliding the blade perpendicular to the gauge. Examine the gauge carefully under diffused light at an inclined angle. The point from which the particles are seen in cluster is considered as the Hegman finish of the material. Repeat the same with the retained approved sample and measure Hegman side by side to compare and report.

ANNEX J**(Foreword)****COMMITTEE COMPOSITION****Paints, Varnishes and Related Products Sectional Committee, CHD 20***Organization**Representative(s)*

In personal capacity (14, Orion, Oomer Park, Bhulabhai Desai Road, Mumbai)	SHRI RAVI MARPHATIA (<i>Chairman</i>)
Addisons Paint and Chemicals Ltd, Chennai	SHRI R. SRINIVASAN
Akzo Nobel Coatings India Pvt Ltd, Bangalore	SHRI DEEPAK VERMA
Asian Paints (India) Ltd, Mumbai	SHRI A. B. MENON DR B. P. MALIK (<i>Alternate</i>)
Berger Paints India Ltd, Howrah	SHRI K. NIRMAL KUMAR SHRI N. K. RAY (<i>Alternate</i>)
Bharat Heavy Electricals Ltd, Tiruchirapalli	SHRI M. SOMU
Central Building Research Institute, Roorkee	DR L. K. AGARWAL DR K. K. ASTHANA (<i>Alternate</i>)
Central Public Works Department, New Delhi	SHRI VIJAY MOTWANI SHRI R. K. KANOJIA (<i>Alternate</i>)
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Consumer Unity and Trust Society (CUTS), Jaipur	SHRI SANDEEP SINGH
Continental Coatings Pvt Ltd, Chennai	SHRI M. B. SATYANARAYANA
Directorate General of Supplies and Disposal, New Delhi	REPRESENTATIVE
Engineers India Limited, New Delhi	REPRESENTATIVE
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Hindustan Shipyard Ltd, Visakhapatnam	SHRI P. V. RAMANA MURTHY SHRI A. P. CH. N. PRASAD (<i>Alternate</i>)
ICI (India) Ltd, Gurgaon	REPRESENTATIVE
Indian Institute of Chem Technology, Hyderabad	DR K. V. S. N. RAJU
Indian Institute of Technology, Mumbai	DR A. S. KHANNA
Indian Paints Association, Kolkata	DR M. B. GUHA SHRI V. M. NATU (<i>Alternate</i>)
Indian Small Scale Paint Association, Mumbai	SHRI VINOD JOSHI
Maruti Udyog Ltd, Gurgaon	SHRI T. K. BANERJEE
Ministry of Defence (DGQA), Kanpur	SHRI M. S. SULTANIA SHRI L. S. MISHRA (<i>Alternate</i>)
Ministry of Environment and Forest, New Delhi	REPRESENTATIVE
Ministry of Industry, New Delhi	SHRI P. K. JAIN SHRI N. C. TIWARI (<i>Alternate</i>)
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Office of the Development Comissioner (SSI), New Delhi	SHRI Y. S. BHATNAGAR SHRI A. K. JAIN (<i>Alternate</i>)

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Punjab Paint Colour and Varnish Works, Kanpur	SHRI G. N. TIWARI
Pushkar Paints Industries, Lucknow	DR DOORDARSHI DIXIT SHRI SUDHIR KESARWANI (<i>Alternate</i>)
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Research Designs and Standards Organization, Lucknow	SHRI M. P. VARMA SHRI V. MURLIDHARAN (<i>Alternate</i>)
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